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ABSTRACT

This project examines the impact of technology on the process of higher education and the impact of these advances on both students and faculty. Student demographics and academic achievement from 30 years ago are compared to those of modern students as reported by veteran and new faculty members. The impact of technology on the modern student is discussed, as are technology-relevant changes in the university experience for students and faculty. The changes in the accessibility of college classes by nontraditional students due to multimedia and Internet technology is also discussed with respect to the changing nature of distance education, including emergence of teleconference courses, Internet-based classes, and other alternatives to the traditional correspondence course. (Author/MSE)

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Then and Now: Technology and the Changing Face of Higher Education

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Abstract: This project examines the impact of technology on the process of higher education and the impact of these advances on both students and faculty. Student demographics and academics qualities from thirty years ago are compared to those of modern students as reported by veteran and new faculty members. The impact of technology on the modern student is discussed, as are technology relevant changes in the university experience for students and faculty. The changes in the accessibility of college classes by nontraditional students due to multimedia and Internet technology is also discussed with respect to the changing nature of distance education, including emergence of teleconference courses, Internet based classes, and other alternatives to the traditional correspondence course.

Introduction

Technology has made many aspects of our lives easier, less worrisome, and much more comfortable. Not all automobiles in 1969 had radios as an option and compact disk players were not even a speculation. Modern conveniences common in 1999 were the stuff of science fiction movies at the end of the 1960's; microwave ovens, home computers, the Internet, and home satellite dish technology were not even very lucid dreams. These conveniences have become near-essentials in lives of many; the institution of higher education is no exception as it has integrated new advances and adapted to the changes these advances have made in the lives of instructor and student alike. Thirty years ago student life was very different for persons engaged in all levels of university education; technology has had a dramatic effect on every aspect of both the graduate and undergraduate experience.

It comes as no surprise that college students now, especially graduate students, rely very heavily on technology in the course of their studies. While this statement may seem obvious, the degree of difference between students, graduate or undergraduate, in 1969 and their counterparts in 1999 is staggering. We expect that the modern student would be computer savvy and accustomed to using information technology in order to produce research projects, complete assignments for class, design and deliver lectures, and to use whatever tools are available for practicum or training in the students specialty concentration. What is not as intuitive is how much the changing face of technology has altered the very nature of what is desirable in a potential doctoral, master's level, or undergraduate student. Skills, attitudes, and beliefs about their particular fields of endeavor considered preferable by admissions committees seems to have coevolved with society's technological sophistication. The very face of the student has changed as well; no longer restricted to higher socioeconomic status individuals under the age of 25, many non-traditional students are finding opportunities for study which were simply not present as little as ten years ago. Knowledge of and familiarity with technology unavailable

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until relatively recently is now considered part of the minimum standards of competency in many academic and applied disciplines. Technology has not only changed what the student has to know to succeed in college, it has also dramatically increased that student's capacity for productive output.

The University Experience

The process of higher education has changed much in the last 30 years; this is not a revelation of any magnitude, but the impetus of these changes are to a degree differentially attributed by new and veteran faculty. Fourteen veteran faculty members (began instructing at the college level before 1976) and 12 new faculty members (began instructing at the college level after 1994) responded to an E-mail survey about changes in higher education. Veteran and new faculty were asked to describe their observations and opinions with respect to their first one to three years as instructors. Veteran faculty members responded that in their first few years of teaching the primary mode of lecture delivery was classroom instruction. Classes were conducted on campus, during the week, between the hours of 8-5. Night or evening classes were uncommon but when offered they were mostly prerequisites and core classes. For content courses and advanced classes students would have to come to the university/college during normal class hours. Correspondence courses were available but the topics were more limited than today's offerings. Correspondence courses generally required the student to come to campus to take exams. Most veteran faculty agreed that a degree could be completed via nontraditional courses but only if the majority of the work had been completed on campus and only if the courses offered in the evening or by correspondence would satisfy the remaining degree requirements. It should be noted that many universities then required, and many still do require, the last several courses in a student's major field of study to be completed on campus. Student's 20-30 years ago would primarily contact instructors by arriving in person at the instructor's office or by telephone. The majority of students resided on campus and a smaller percentage lived off campus near their university. Students commuting from another town, city, or nearby area was generally rare. The veteran faculty members who responded to the E-mail survey believed that social and policy changes, along with the greater availability of financial aid, had the most pronounced impact on both the student body demographics and on the university experience itself. They noted that advances in technology, specifically the advent of the home computer and the dawn of the age of the Internet, produced changes secondary to those of the changes in society itself.

New faculty agreed that the primary mode of lecture delivery was in the classroom during normal business hours, but many noted that alternatives were available for students who could not attend formal classes. Traditional correspondence courses are still offered, but the faxing or E-mailing of assignments is available as an alternative to the regular post or hand delivery. A wider variety of offerings is present today as opposed to 30 or even 15 years ago. Alternative instruction includes more than just evening/weekend classes and traditional correspondence; Distance Education departments offer Internet-based instruction, televised courses via satellite, courses on video cassette and CD-ROM, and even video-conferencing of courses to several locations at once. The new faculty noted that undergraduate degrees were easily completed by use of alternate means; such as extension campuses, internet courses and distance education. The changes in instruction on the university level are centered on information and computer technology. Veteran faculty reported that the library was the primary source of materials for undergraduate papers. New faculty note that the library is still the source of choice, but an important alternative has surfaced in the last ten years: the Internet. Many students are conducting their literature reviews and searches on the Web; the major professional publication/style manuals now recognize on-line and other web based citations. Specialized search engines and specific on-line information services such as PsychInfo, ERIC, Medline, and dozens of others provide relatively easy and rapid access to specific information. E-mail gives the more industrious student direct access to many sources of information once accessable only by the regular mail. Students now also have access to their professors via E-mail as well; personal visits and phone calls are still the modes of choice, but E-mail communication is rapidly gaining in popularity.

The advent of the computer and its accompanying advances have changed much more than just the dynamics of the higher educational process and the university/college experience, it has changed the demographics of the student itself. Veteran faculty members noted that, in their first three years of teaching, the typical student was Caucasian, upper middle or upper class, unmarried, under the age of 24, and likely to be male. Minority students were rare and female students, while not uncommon, did not make up an even proportion of the student body. New faculty members report that the majority of students are likely to be Caucasian and male, the notion here of a majority may be a misnomer. Most university campuses serve diverse populations, but even this intuitive statement does not accurately describe the population. Examining the

demographics of the modern student body can we see the major interaction between social policy change and the advances in technology. Social policy changes in the form of anti-discrimination laws and equal educational opportunity statutes greatly increased access to higher education for non-majority students. As computer and information systems technology became incorporated in the process of higher education at about the same time as many of these social changes were beginning to take effect a dramatic change in demographic nature of students can be observed, a change most likely due to the interaction between these two forces. An increasing number of non-traditional students began returning to school and their numbers rise with each successive year. Many are returning for advanced degrees to meet the needs of an increasingly competitive marketplace; for others it will be their first exposure to higher education. Some will attend traditional classes but many will take advantage of non-traditional course times and formats; for them these alternative courses may be their only opportunity to pursue a college degree. As the demands of the modern workplace change the engines which support it change as well. Advanced technology is on the forefront of these changes.

The new faculty members surveyed differed in their opinions and observations to a degree. They believed that the personal computer and the Internet were the most influential in establishing changes in the educational experience. The simple availability of these tools has dramatically altered the college experience for professors and students alike. The second most important influence noted by new faculty is the rapid increase in technological sophistication in the workplace; to be productive and competitive a worker must know how to employ and maintain the tools of their trade. Clearly, a place to learn technology competency is during the educational experience in college. While this second observation may seem intuitive, the incorporation of computer and electronic technology into all areas of American life today is extensive, likely more so than would have been projected 30 years ago. Computers are everywhere in modern society. Automobiles, cash registers, gasoline pumps, kitchen appliances, vending machines, and many other seemingly common devices now are fitted with intricate computer cores. Advanced electronics have crept into modern life with equal influence on seeming everyday conveniences. Many specific products common today were not available 30 years ago, many not even conceived as the stuff of science fiction. While the future failed to provide the citizens of 30 years ago with personal jet-packs and colonies on the Moon, it did deliver compact disc players, cable and satellite television, laser surgery, advanced optics, microwave ovens, electric and solar powered automobiles, Fax machines, voice mail, and many other advances now considered to be relatively commonplace. Operating, repairing, building, or designing these devices requires a level of skill and knowledge not available 30 years ago. The modern workplace demands a minimal level of sophistication from each and every employee, regardless of their position. In the same way that a modern architect generates a building design on a computer, a modern cashier must be able to program and operate a computerized cash register. The new faculty members did give credit to the forces of social change, but clearly in their opinions social forces were less influential than technology. It is more than likely that the change is attributable to an interaction between technology and social change, indicating that somewhere in between these relatively specific advances lies the actual agent of progress.

Technology and The Modern Student

It seems that the battle cry of faculty across disciplines heard echoing throughout college campuses in the United States is "read the textbook"! Many instructors believe their students could generate higher quality work and achieve substantially better grades if only they would study the course text and the lecture materials. Faculty of all levels of experience generally agree that students demonstrated a higher level of dedication to their studies in the past than is present now. While this argument is not often contested many critical supporting elements are often not given due consideration. The college student of the late 1960's or the early 1970's did not have access to the same technology as today's students. Yesterday's college student likely had fewer than ten channels of television, no access to a personal computer, no Internet service, no video games, no Fax machines, no E-mail, and certainly no access to courses on videotape, to name a few of the salient differences. Social conditioning was different. The technology which now expedites life simply was not in existence or did not have nearly the same impact. To learn a student needed to read a textbook, attend classes, and use a card catalog-referenced library. Some would argue that this student had more patience and determination; while this judgment is certainly face valid, it is also equally accurate to note that the students of the past simply became accustomed to waiting for the less efficient methods at their disposal to produce the desired results. Papers which had to be typed may have taken several iterations by longhand before a final draft was completed. Mistakes on a typewriter could very easily necessitate the retyping of an entire page or section; this is not a concern with modern word processing software. Completing a ten-page term paper is considerably easier with the assistance

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of a personal computer or even a computerized typewriter, not to mention the added assistance of the Internet and on-line reference engines available at the university library. Subjective comparisons of quality between students then and students now are actually more confounded than they may seem on the surface when the differences in available resources and methods are taken into the equation. While both would need a degree of intellect appropriate to their field of study and the expected collection of motivational and supporting variables, the specific skills present in modern students are often technology centered. This provides both the advantage of the availability of the efficient resources of the Internet and of the personal computer and the disadvantage of the dependency on technology to be effective.

Students beginning their university careers in the early 1990's to present have received extensive social conditioning with regard to technology. The impact of this conditioning has been both direct and indirect. Students today grow up in a world of ready convenience; fast food, instant long distance telephone connections, credit cards with instant approval, Automatic Teller Machines, and many other areas that are infiltrated by technology. Stories of the past notwithstanding, modern students have little connection to life without these direct and indirect influences of technology. The vast majority of colleges and universities in the United States offer many of these and other conveniences on campus. Students are conditioned to expect more immediate results from their efforts in all aspects of daily life as compared to their predecessors. This expectancy generalizes well to their studies. Modern students can research a term paper in considerably less time using electronic indices in the university library than was possible using a card catalog. A first draft of a paper can be edited with the assistance of a word processing program, making obsolete the need for pen-and-paper outlines and drafts. The final paper then is printed with the touch of a button, a process much more rapid than typing from a hand written draft using a manual typewriter. Many textbooks now come with content-relevant CD-ROM's or floppy discs. Instructors are beginning to list supplementary sources on their syllabi in the form of web sites devoted to the topic instead of using materials on reserve at the university library. The publishers of many textbooks, in an effort to make their product more marketable to colleges and universities, now offer content-relevant web sites accessible only with a code from the student's textbook. All of these advantages, if they are to be utilized efficiently, demand that the modern student demonstrate specific prerequisite skills to access the information or use the available tools.

A student who cannot use a computer suffers a serious disadvantage in today's university setting. Word processing is more than simply knowing how to type; it requires the applicable knowledge of the software's capabilities and a familiarity with both the general lexicon of the computer age and the specific terminology to navigate the software's various utilities. Students without Internet skills literally have only a fraction of the resources available to them compared to their Internet-savvy colleagues. In many cases the lack of skill in using local area network (LAN) search engines can critically hinder a student; many college and university libraries have eliminated their card catalogs. Knowledge of word processing and the Internet, while a substantial part of the constitution of the desirable skills in a modern student, are not the only important elements. Familiarity with software for designing presentations, for example, is rapidly becoming a requirement for graduate studies in general and for many undergraduate majors as well. The ability to use E-mail for more than simply sending messages is another rapidly developing requirement. Many professional conferences accept on-line submissions, many potential employers require work samples be sent via E-mail; this may require the ability to attach pictures or graphics, convert text from one format to another, import charts and statistical diagrams from specific programs and incorporate them into the final product, and present the effort in a uniform and easily understood manner. Simply understanding the operation of a personal computer does not convey the ability to maximize its capabilities. While speculations of a paperless society by the proponents of computer technology are likely premature, the advantage of the fax-modem is not to be underestimated. Graduate and undergraduate students alike who can compose and send by fax a document without leaving their terminals possess a great advantage. Many professors allow the E-mailing and/or faxing of reports and other assignments as an increasing number of students commute to their college or university from some distance away. These skills and others allow a modern student to maximize the educational experience by utilizing available resources efficiently; students without these skills suffer a distinct disadvantage, a disadvantage that will only become more detrimental as institutions of higher learning embrace advances in technology.

Most institutions now have programs in place to meet this need. Most colleges and universities now offer a course that essentially serves as an introduction to the university itself. In such courses the student is introduced to the university's resources and receives basic instruction on their use, including the use of computer based facilities. Many universities offer clinics and other forms of instruction designed to introduce the new student to word processing, Internet and E-mail utilization, availability of services and alternate course formats, and training on discipline specific software packages. Almost every modern university now offers computer labs

and facilities staffed with personnel trained to assist students in the use of these facilities and to troubleshoot specific problems encountered in either the learning process or the application of computers and software to the student's course requirements. Many faculty members have begun requiring Internet assignments from their students as a method of ensuring that the student has at least a basic level of knowledge of how to navigate the Internet and of the operation of Internet browser software. As class presentations in both graduate and undergraduate courses of study become more and more dependent on multimedia applications, many instructors are coordinating with university departments which offer instruction in presentation software to ensure that their students have every opportunity to acquire the skills necessary to generate high quality work. A quick search of the Internet will reveal a large number of course syllabi and lecture notes or supplemental materials posted by faculty for their students and other visitors. Such postings serve as motivation for students to use the Internet for their academic careers. As students become used to acquiring information from the Internet, they will likely begin to perform searches for information related to their studies or other aspects of their future careers.

How important is the Internet and the personal computer to current students? A survey was presented to 68 students in an upper division psychology class in a mid-sized university in Louisiana. These students indicated that they believed persons with current Internet and computer skills will have a distinct advantage in the job market. On a scale of 1-10 where 10=very important and 1=not at all important, the mean response of these students to the importance of Internet and computer skills to future employment success was 7.04; 62% (44 of 68) rated this item's importance as 7 or higher. These students also indicated that computer and Internet skills will be a requirement in the future for college students. Their mean response to the question of how likely such skills were to be a requirement in the future was 6.92; 56% (38 of 68) rated the likelihood as 7 or higher. When asked how important technology would be with respect to their future careers the mean response was 6.3 on a scale of 1-10, 48% (33 of 68) rated the importance of computer technology to their future careers as 7 or higher. Of the students in this informal survey, 70% (498 of 68) reported that they owned or had access to a computer in their primary residence. 72% (49 of 68) reported that they had access to the Internet at their place of residence. 81% (55 of 68) reported that they were familiar with the basic operation of a home computer. 66% (45 of 68) reported that they used a computer for writing class assignments at home or at school. 48% (33 of 68) reported that they believe textbooks will be entirely replaced by CD-ROM's in the future.

Technology's impact is profound in the life of the traditional student, but many nontraditional students may very well owe their academic existence to computer technology. Every state in the U.S. now has at least one university or college that offers some form of distance education apart from the traditional correspondence course. The new wave of distance education is the teleconference course. Instructors in one setting, possibly hundreds or thousands of miles away, are connected in real time to students in a classroom via satellite audio/visual technology. The potential for such instruction is staggering; students unable to commute to a traditional or night/evening class now have access to university instruction. Internet based classes are developing almost as rapidly as remote conferencing; a quick search of the Internet will reveal many offerings for web-based courses, many with online exams and assignments. The Internet class is the natural evolution of the correspondence course of old; where correspondence courses could reach anyone with a mailbox and a free day to come in and take an exam. The Internet now serves as an extension campus in everyone's living room. Many universities allow remote access to their libraries' facilities via the Internet. On-line, peer reviewed journals have begun to appear in many fields, offering the modern nontraditional student access to current research and theory without having to make a trip to the university's library. The importance of these developments to the nontraditional student cannot be overemphasized; single parents, shift workers, military service members, persons unable to commute to a traditional university, and many others now have opportunities simply unavailable before the advent of computer and satellite technology.

Technology and the Modern Faculty Member

Technology has not simply impacted the lives of students; the advent of the computer and the Internet has had a profound impact on faculty members across disciplines in higher education. The same advances that have impacted the modern student have also influenced the instructional style and careers of modern faculty. Professors and graduate teaching assistants now have ready access to multimedia aids and information which was previously either difficult to acquire or simply unavailable. Once again the Internet and the personal computer appear as primary agents of this change. Faculty members can communicate with colleagues via E-mail much more easily and cost-effectively than by telephone or even by fax. Lesson plans and exams can be devised using word processing software with the same efficiency as that experienced by a student writing a term

paper. Presentation software and modern multimedia equipment have added a new element to classroom lectures. Teaching is not the sole area of influence for the computer in academia, however; computer technology has quickly established itself as indispensable in all areas of research. Professors and graduate assistants now have the potential to be considerably more productive with the aid of computers and specialized software. Statistics packages such as SPSS have literally reduced the time involved in data analysis to a fraction of that which was required to compute the figures by hand. Speed is not the only advantage of such programs; the accuracy of a computer greatly reduces the chance of human error. Many potentially valuable statistical procedures and research methods previously considered prohibitively time consuming and cumbersome to be of any utility are now in regular use due to the availability of computers and specialized software. The Meta-Analysis, for example, is an invaluable tool for outcome research in almost every applied discipline. Advanced software packages for this specific procedure have reduced the time necessary for a Meta-Analysis to a fraction of the original time required, normally many months (and in some cases, years). These advances have also allowed research-oriented faculty to essentially engage in a form of academic multitasking. The potential productivity for faculty and graduate students involved in active research is much greater now due to current technological aids, but the same prerequisites are in force for the faculty as for the students; before a computer or a software package is any utility, the professional must first know how to use it efficiently.

Conclusion

The university experience for both the graduate and undergraduate student is dramatically different now than it was 30 or even 15 years ago. While many of the same qualities are desirable in modern students as were generally present in students of the early 1970's, modern students are required to have a level of knowledge about computers and advanced technology not present in their predecessors. Modern students are technology dependent, but this is a statement that simply reflects the current state of our society. The Internet, while relatively young, has become an ingrained part of American life both on and off campus. The computer has rapidly grown from an expensive curiosity to a basic household appliance and educational tool. The modern student must be computer savvy in order to maximize the university experience and it appears that the modern student is aware of this fact. Academic life is rapidly moving forward to maximize computer and multimedia technology and the effects of this movement can already be seen in almost every institution of higher learning in the country. In comparison to thirty years ago, much has changed with respect to the college experience. Traditional student bodies are much more gender-balanced than before, campus populations are more diverse, possibly to the point of making the term "majority" a misnomer. Even within the Caucasian-male student body greater diversity exists now as opposed to thirty years ago. No longer is a college education restricted to the upper strata of American society or to a specific geographic location. Modern students have the opportunity to access more information with greater speed and efficiency. Faculty members have useful new tools available to design not only traditional courses of instruction but to take advantage of a nontraditional body of students formerly restricted from higher education due to various constraints in their lives. Internet based instruction, teleconference classes, courses on videotape, and other products of the multimedia/computer fusion have extended access to college courses beyond the campus grounds. Faculty members have seen a number of direct benefits from computer and software advances as well; research productivity and teaching efficiency have dramatically increased and likely have not yet reached their apex. As for the future, it is likely that once computer skills have become a requirement for college attendance or a faculty position we can expect to see an increase in the requirements for the successful completion of a class or for a professor's tenure. As a group becomes more productive the requirements always increase to match productivity. While this is merely speculation, it will be interesting to examine the state of theory in academia 30 years into the new millennium. Technology has dramatically impacted research, but the theoretical engine which drives academic pursuits has not been as affected; while colleagues can teleconference and discuss postulations and principles, no computer or software currently available will be able to directly influence the development and delineation of academic theory in any discipline.

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